UNITED STATES · ENVIRONMENTAL PROTECTION AGENCY

STRUCTURAL CONDITION SURVEY

LAND REUTILIZATION AUTHORITY
OWNED PORTION
of
CARTER CARBURETOR FACILITY
ST. LOUIS, MISSOURI

JULY 1995

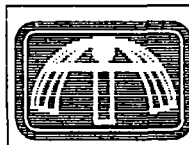07JJ   1.0

DU-OO   72136

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ST. LOUIS, MISSOURI

EPA Contract No. 68-S2-7002
EPA Delivery Order 7002-032

JULY 1995

Prepared by

TapanAm Associates, Inc.
Leawood, Kansas and
Kansas City, Missouri
For
U.S. Environmental Protection Agency
Region VII
Kansas City, Kansas

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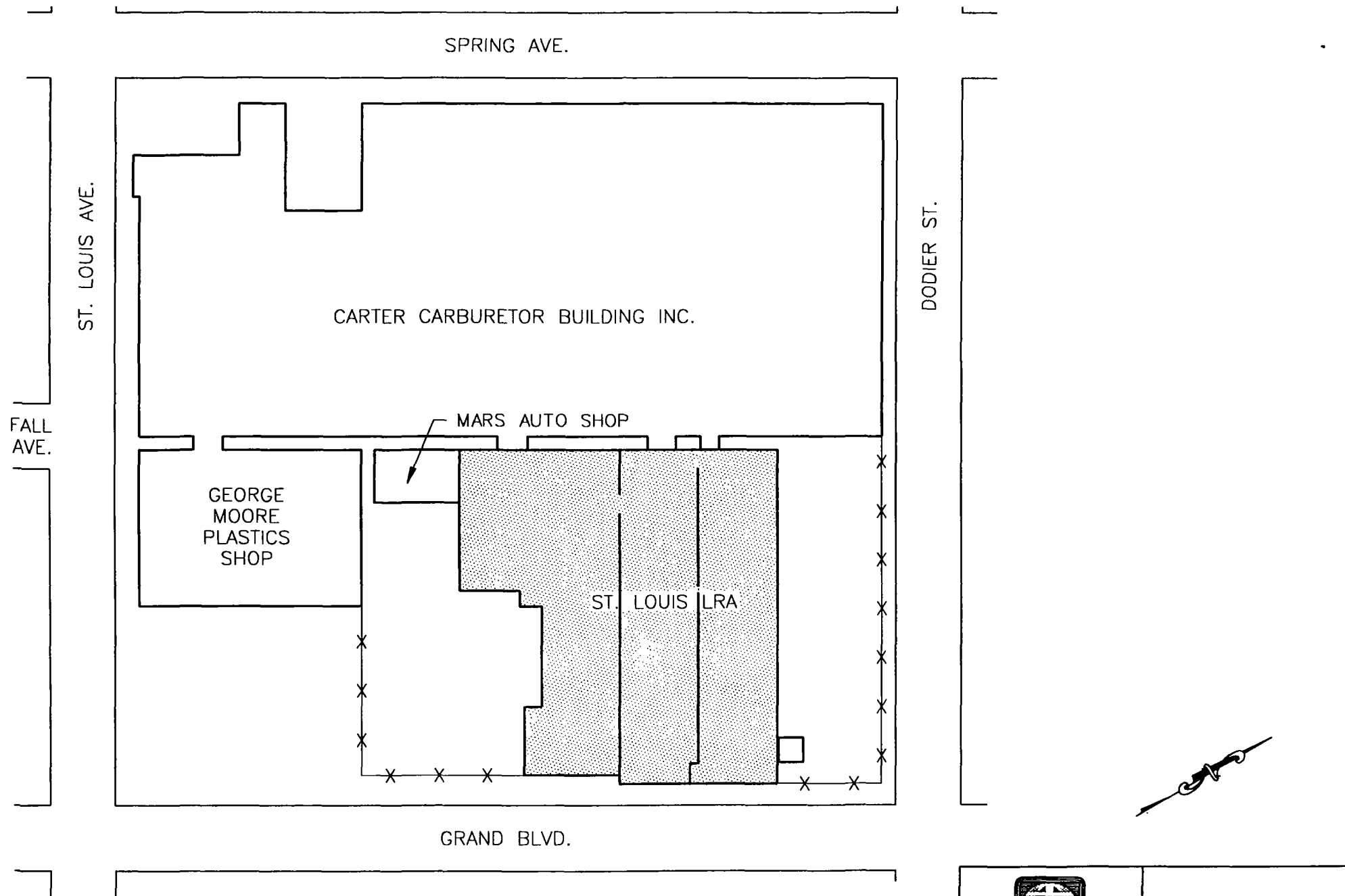* * * * *

STRUCTURAL CONDITION SURVEY

INTRODUCTION

TapanAm Associates, Inc. was retained by the United States Environmental Protection Agency (EPA) Emergency Planning and Response (EP&R) Branch, Region VII, to conduct a structural condition survey of the northeastern portion of the former Carter Carburetor facility located at 2829 to 2861 North Grand Avenue in St. Louis, Missouri. Site activity included visual observations of the building structural systems with conditions noted on field survey sheets. Background information concerning the construction of the buildings was researched at the City and County of St. Louis Building Department. Some building plans were obtained by Joe Davis of Ecology & Environment, Inc, Technical Assistance Team (TAT) from the central files of City's Building Department.

A site visit was made on May 11, 1995 to conduct visual observations of the building structure. During the site visit, the condition of the buildings components were noted, and documented with photographs. These field observations are provided in Appendix A and the photographs in Appendix B. A condition survey report with debris quantities and opinion of probable costs was prepared after completion of the field survey.

BACKGROUND

The former Carter Carburetor facility manufactured equipment for gasoline and diesel-powered engines dating back to the 1930's. Aluminum and zinc were die cast and machined into carburetor components. Those components were then treated with protective coatings and assembled on site.

Carter Carburetor and Carter Automotive Products were subsidiaries of ACF Industries, Inc. In the mid-1980's, ACF closed the facility and the equipment was dismantled, and either shipped to new locations or sold. The Land Reutilization Authority of St. Louis (LRA) accepted title of the property from ACF in April of 1985 and on the same day sold the property to Hubert R. Thompson who subsequently defaulted on the property loan. LRA was informed by ACF that electrical equipment on site contained polychlorinated biphenyls (PCBs). Later sampling of the die cast buildings on LRA property, identified contamination on equipment base pads, electrical conduits, pipes, etc. In October, 1991, Carter Building Inc. acquired the west half of the facility and the St. Louis LRA retained the northeastern portion of the facility. A site plan is shown in Figure 1.

SPRING AVE.

ST. LOUIS AVE.

DODIER ST.

FALL
AVE.

CARTER CARBURETOR BUILDING INC.

MARS AUTO SHOP

GEORGE
MOORE
PLASTICS
SHOP

ST. LOUIS LRA

GRAND BLVD.

PLAN
NO SCALE

TapanAm Associates, Inc.
Engineers ; Architects

FIGURE 1
SITE PLAN

PURPOSE

The purpose of this survey is to evaluate the structural condition of the Land Reutilization Authority (LRA)-owned portion of the Carter Carburetor Facility as shown by the floor plan in Figure 2. The buildings owned by LRA consist of three buildings sharing common dividing walls and interconnected by passage ways to the main Carter Carburetor manufacturing building. The condition survey was directed towards the overall condition of the three buildings that would contribute to instability of these structures and the safety of the cleanup crews. The condition survey and subsequent structural evaluation would assist the EPA in determining the feasibility of decontaminating the inside of the buildings, or the complete removal of one or more of the buildings.

FIELD OBSERVATIONS

The walk through of each building was conducted with visual observations recorded on survey data sheets. Each survey data sheet notes the building area, date, and the major building structural element as well as appurtenances. The field notes have been typed, and are provided in Appendix A.

Our field observations for each building and its structural elements is summarized below. Photographs are provided in Appendix B.
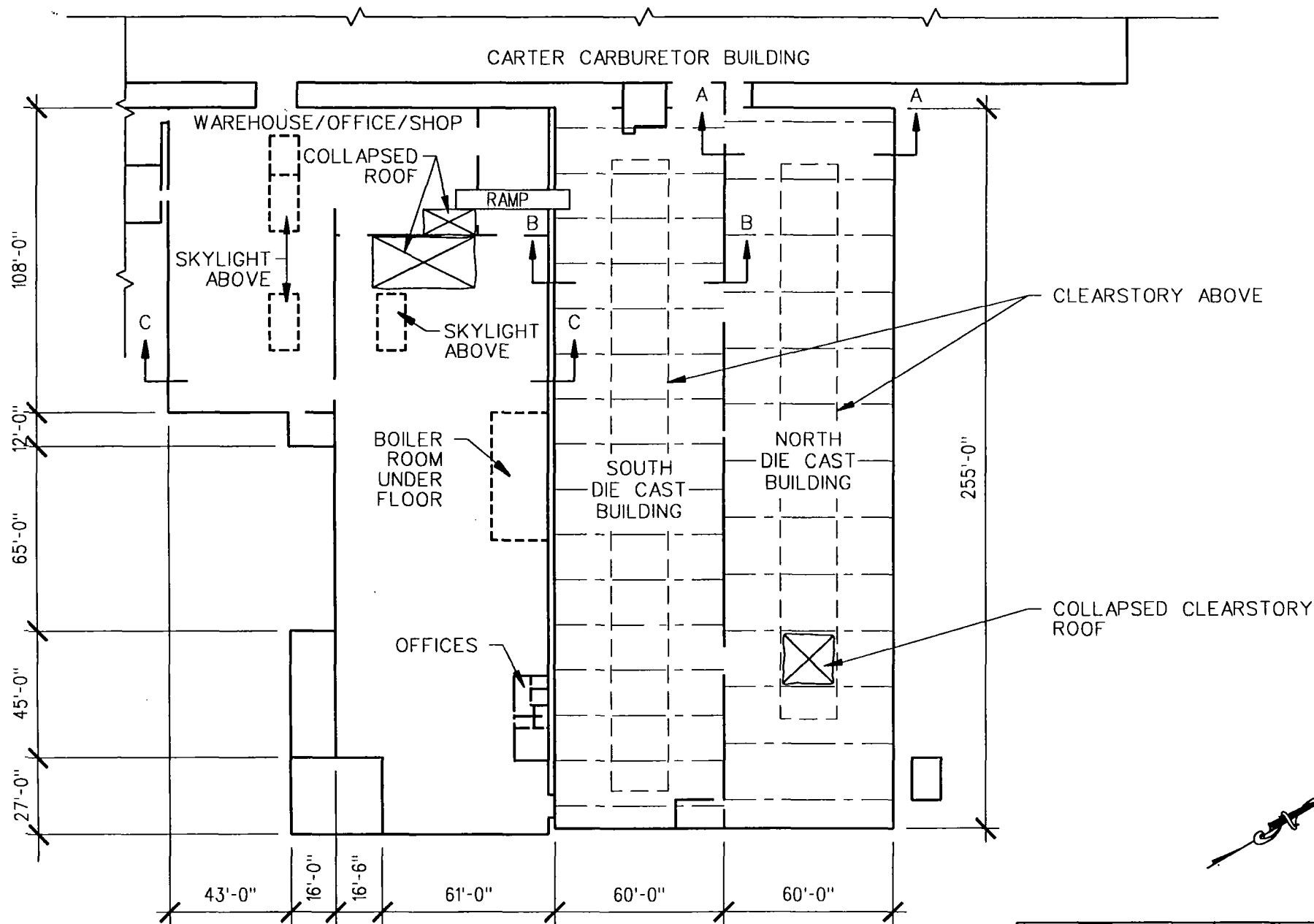
North Die Cast Building

General

The North Die Cast building is a long narrow building having a column free floor area. The finish floor is lower than the outside grade and is accessed by stairs. A clearstory above at the roof provided natural lighting to the floor below. A section of the building is shown in Figure 3.

Roof Substrate & Framing

The roof is a built-up system consisting of felt and gravel over timber decking. The roof framing consists of timber joists spanning between roof trusses the length of the building. A clearstory spans across the top of the roof trusses down the center of the building. The clearstory is framed with timber sidewalls having full height windows (glass, frame and sash). Likewise, the clearstory roof framing consists of timber joists and decking with a built-up roof covering. (Photo No. 8)

Primary Framing

The primary framing consists of masonry bearing walls and steel roof trusses spaced at 20 feet on center. The roof truss configuration is a bowstring truss fabricated from structural steel

CARTER CARBURETOR BUILDING

WAREHOUSE/OFFICE/SHOP

COLLAPSED ROOF

RAMP

SKYLIGHT ABOVE

SKYLIGHT ABOVE

BOILER ROOM UNDER FLOOR

OFFICES

SOUTH DIE CAST BUILDING

NORTH DIE CAST BUILDING

CLEARSTORY ABOVE

COLLAPSED CLEARSTORY ROOF

108'-0"
12'-0"
65'-0"
45'-0"
27'-0"

255'-0"

43'-0"   16'-0"   16'-6"   61'-0"   60'-0"   60'-0"

A   A

B   B

C   C

PLAN

NO SCALE

NOTE:
DIMENSIONS INDICATED WERE ESTIMATED
FROM EXISTING DRAWINGS.

TapanAm Associates, Inc.
Engineers   :   Architects

FIGURE 2
LRA BUILDING
FLOOR PLAN

60'-0"

20'-0" | **20'-0"** | **20'-0"**

WOOD FRAMED
CLEARSTORY

5'-0"

9'-0"

±12½" CLAY
BRICK WALL

STEEL TRUSS
@20'-0" O.C.

±12½" CLAY
BRICK WALL

17'-5"

14'-0"

±8" CONC. FLR. SLAB

3'-5"

5'-0"

1'-4"
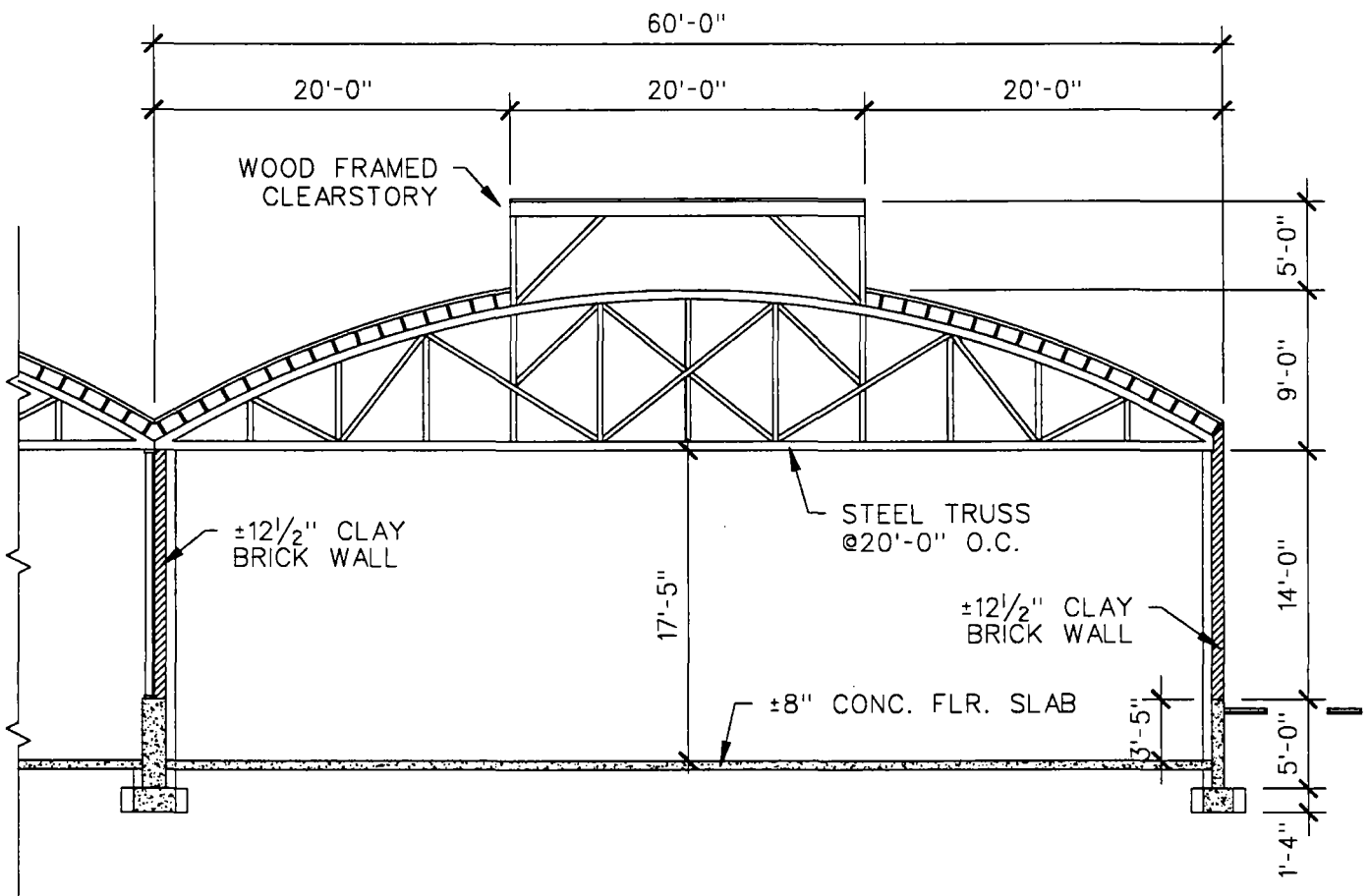
SECTION A-A
NO SCALE

NOTE:
DIMENSIONS INDICATED WERE ESTIMATED
FROM EXISTING DRAWINGS.

TapanAm Associates, Inc.
Engineers . Architects

FIGURE 3
**NORTH DIE CAST
BUILDING
SECTION**

angles. The trusses span the width of the building bearing on a solid clay brick wall at both the north and sides of the building. (Photo Nos. 7 and 8)

Lateral Bracing

The lateral restraining system for the building utilizes the roof as a diaphragm and x-bracing located in-plane with the bottom chord of the roof truss.

Appurtenances

Appurtenances, such as light fixtures, electrical conduit, fire sprinkler piping, steel angle pipe rack, and process piping were observed throughout the building. (Photo Nos. 5, 6, 7, and 8)

Foundations

The loading bearing masonry walls are supported by reinforced concrete foundation system consisting of a stem wall and strip footing with an integral pier and spread footing at each masonry pilaster supporting the roof truss. The top of the stem wall is approximately 8 to 10 inches above parking lot asphalt surface and 3'-5" above the finish floor elevation. (Photo No. 5)

South Die Cast Building

General

The South Die Cast building is a long narrow building having a column free floor area. The finish floor is lower than the outside grade and is accessed by stairs. A clearstory above at the roof provided a natural lighting to the floor below. A section of the building is shown in Figure 4.

Roof Substrate & Framing

The roof is a built-up system consisting of felt and gravel over timber decking. The roof framing consists of timber joists spanning between roof trusses the length of the building. A clearstory spans across the top of the roof trusses at the center of the building. The clearstory is framed with timber sidewalls having full height windows (glass, frame, and sash). Likewise, the clearstory roof framing consists of timber joists and decking with a built-up roof covering. (Photo Nos. 9, 10 and 12)

Primary Framing

The primary framing consists of masonry bearing walls and steel roof trusses spaced at 16 feet on center. The roof truss configuration is a bowstring truss fabricated from structural steel angles. The trusses span the width of the building bearing on a clay brick masonry wall along
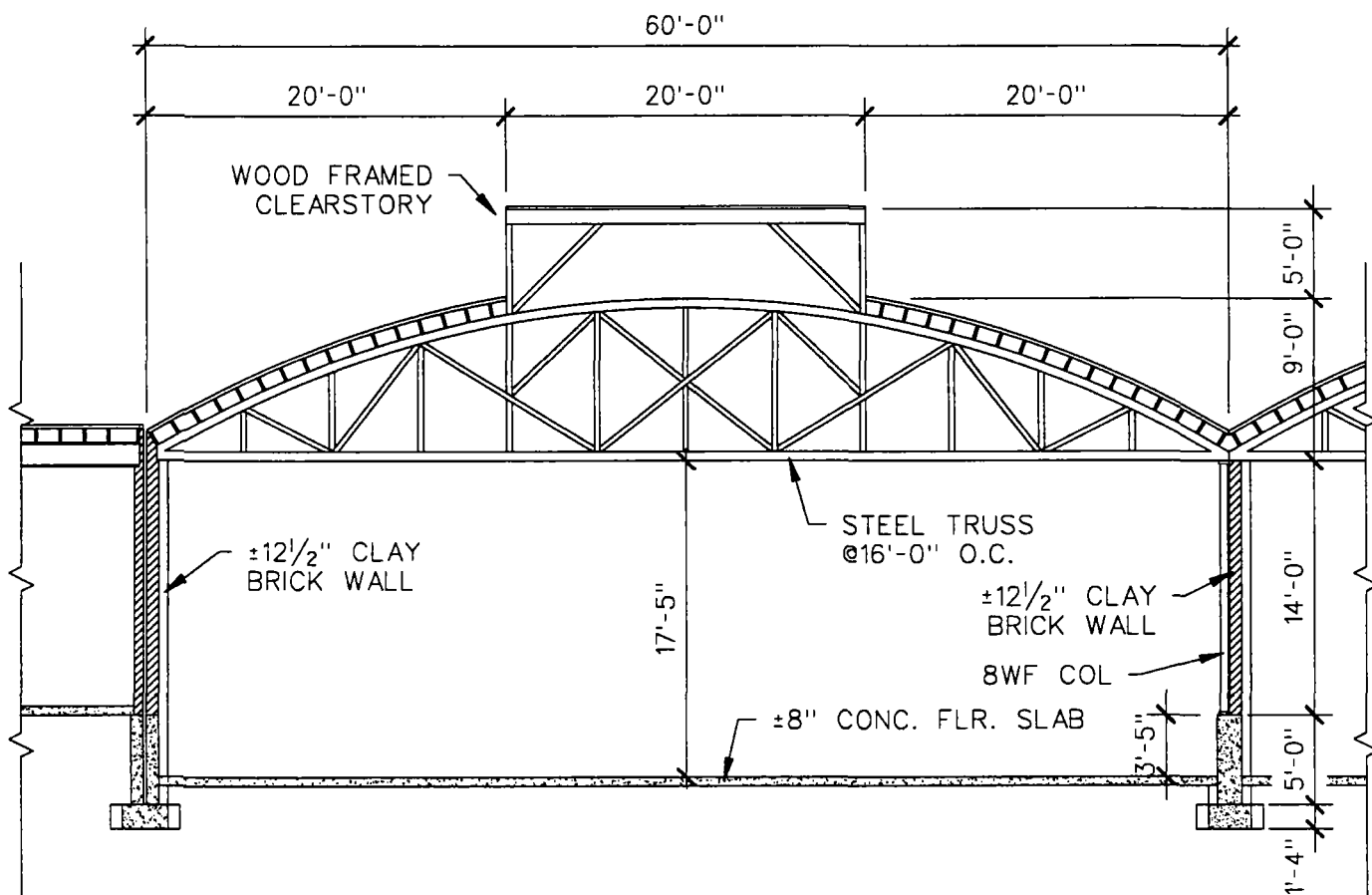
60'-0"

20'-0" 20'-0" 20'-0"

WOOD FRAMED
CLEARSTORY

5'-0"

9'-0"

STEEL TRUSS
@16'-0" O.C.

±12½" CLAY
BRICK WALL

±12½" CLAY
BRICK WALL

17'-5"

8WF COL

14'-0"

±8" CONC. FLR. SLAB

3'-5"

5'-0"

1'-4"

SECTION B-B
NO SCALE

NOTE:
DIMENSIONS INDICATED WERE ESTIMATED
FROM EXISTING DRAWINGS.

TapanAm Associates, Inc.
Engineers . Architects

FIGURE 4
**SOUTH DIE CAST
BUILDING
SECTION**

the south side and supported by a wide flange (WF) column and reinforced concrete pier combination at the common wall with the North Die Cast Building. (Photo No. 11)

Lateral Bracing

The lateral load restraining system for the building utilizes the roof as a diaphragm and x-bracing located in plane with the bottom chord of the roof truss.

Appurtenances

Appurtenances, such as light fixtures, electrical conduit, fire sprinkler piping, process piping, sheet metal hoods, and abandoned floor mounted process equipment, were observed throughout the building. (Photo Nos. 9, 10, 11 and 12)

Foundation

The loading bearing masonry walls are supported by a reinforced concrete foundation system consisting of a stem wall and strip footing with an integral pier and spread footing at each masonry pilaster and each steel column supporting the roof trusses. The top of the stem wall and pier is approximately 3'-5" above the finish floor elevation. (Photo Nos. 10, 11 and 13)
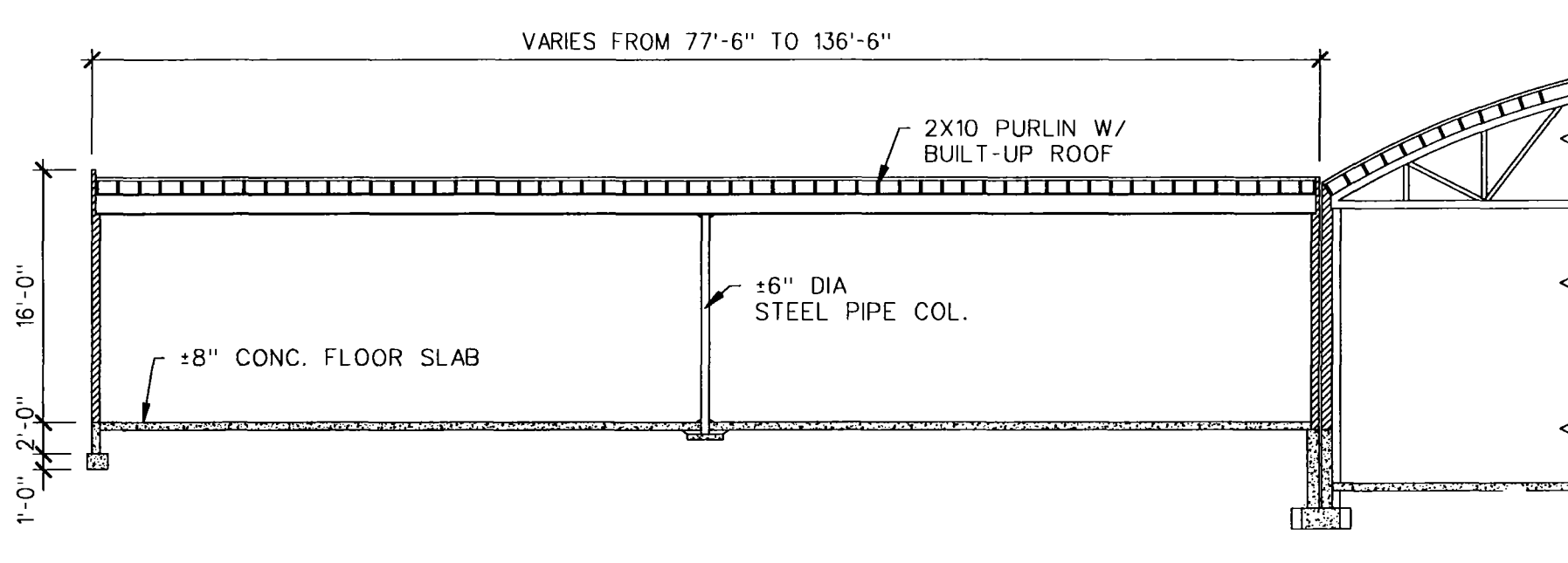
Warehouse/Office/Shop Building

General

The Warehouse/Office/Shop Building is a single story structure with the finish floor at grade. Exterior walls are a combination of solid clay brick and concrete masonry units. Skylights provided natural lighting to the floor below. A section of the building is shown in Figure 5.

Roof Substrate & Framing

The building roof is a built-up system consisting of felt and gravel over timber plank decking and joists at 16 inches on center spanning to beams supported by the perimeter walls and interior columns. Large openings have been framed for what were skylights. (Photo Nos. 14 and 15)

Primary Framing

The primary framing consist of brick masonry bearing walls, rolled steel beams and columns. The common wall with the South Die Cast Building is a cavity type wall with the primary framing bearing on single wythe of brick and separate foundation stem walls. (Photo Nos. 13, 14, 15 and 16)

VARIES FROM 77'-6" TO 136'-6"

2X10 PURLIN W/
BUILT-UP ROOF

±6" DIA
STEEL PIPE COL.

16'-0"

±8" CONC. FLOOR SLAB

2'-0"

1'-0"

SECTION C-C

NO SCALE

NOTE:
DIMENSIONS INDICATED WERE ESTIMATED
FROM EXISTING DRAWINGS.

TapanAm Associates, Inc.
Engineers : Architects

FIGURE 5
WAREHOUSE/OFFICE
& SHOP BUILDING
SECTION

Lateral Bracing

The lateral load restraining system for the building utilizes the roof as a diaphragm transferring laterals loads to the perimeter masonry walls. (Photo No. 15)

Appurtenances

Appurtenances, such as loose ceiling tiles and furring strips, were observed throughout this area. (Photo No. 14 and 15)

Foundation

The load bearing masonry walls are supported by a reinforced concrete foundation system consisting of a stem wall and strip footing. Each interior steel column is supported by spreading footing below the floor slab. (Photo No. 16)

STRUCTURAL CONDITION

Each building was evaluated as to its overall condition and stability of the structure. Some areas of the buildings show evidence of deterioration which can contribute to instability and unsafe conditions.

Observations of the overall condition for each building is summarized below.

North Die Cast Building

The exterior surfaces of the masonry walls show deterioration of the mortar joints due to exposure to the elements and its age. The masonry shows its age by the mortar joints. The mortar joints have softened and are recessed from brickface allowing for moisture penetration into the brick wall. (Photo Nos. 3 and 4)

The visible portions of the foundations and floor slab revealed no signs of major damage other than minor cracks. Observations of the primary framing also revealed no major damage and appears to be in serviceable condition.

The roof framing for the clearstory show signs of sagging, and has collapsed in the vicinity of the third truss spacing from Grand Avenue. The roof substrate and framing at top of masonry also shows evidence of deterioration, such as missing fascia boards and substrate, and exposed roof joists at the eave edge. The roof substrate and framing do not appear to be in serviceable condition to provide a watertight building. (Photo Nos. 2 and 17)

South Die Cast Building

The visible portions of the foundations, masonry walls, and floor slab revealed no signs of major

damage other than minor cracks. Observations of the primary framing also revealed no major damage and appears to be in serviceable condition.

The roof framing for the clearstory show signs of sagging and rotting. No collapse of the clearstory roof framing has occurred at the time visual observations were made. The roof substrate and framing do not appear to be in serviceable condition to provide a watertight building. Major repair and replacement would have to be undertaken to have a serviceable roof system. (Photo Nos. 18 and 19)

Warehouse/Office/Shop Building

The visible portions of the foundations, masonry walls and floor slab revealed no sign of major damage other than minor cracks. Observations of primary framing revealed no major damage and appears to be in serviceable condition.

The roofing substrate and framing shows signs of sagging and in some areas it has collapsed. Major repair and replacement would have to be undertaken to restore building to serviceable condition. (Photo Nos. 19 and 20)

Skylights penetrate the roof with the glass missing and exposing the underside of the roofing substrate and framing and the interior to the elements. Evidence of deterioration was observed in the vicinity of the openings for the skylight and collapsed area of the roof. Interior damage is accelerated due to the continual exposure to rain, sleet, ice, or snow throughout the year. (Photo Nos. 21 and 22)

DEMOLITION DEBRIS ESTIMATE

The quantity of debris was estimated in tons for each building and is summarized by category in Table 1 and supporting calculations are included in Appendix C.

The total demolition debris is estimated to be 6,359 tons. The portion which is for the concrete foundation and concrete floor slab nearly equals 3,970 tons and that portion for the superstructure (walls, roof framing above) nearly equals 2,290 tons. The debris associated with appurtenances (piping conduit, ducts, etc.) is estimated to be 97 tons.

The volume of debris calculated by estimating the bulk density for the various building materials is approximately 6500 cubic yards. A factor was applied to the roofing substrate, brick masonry, and reinforced concrete to account for the bulking effect, i.e. the expansion of its in-place volume due to the razing of the structure. These factors are listed in the summary provided in Appendix C.

Table 1
Demolition Debris (Tons)

Debris Category	North Die Cast Building	South Die Cast Building	Warehouse Office/Shop	Total
Roofing Debris	79	82	186	347
Roof Framing	27	31	39	97
Clearstory	84	87	--	171
Masonry Walls	518	315	841	1674
Subtotal	708	515	1066	2289
Foundation	352	361	356	1069
Floor Slab	769	799	1336	2904
Subtotal	1121	1160	1692	3973
Cupolas, Stacks, Hoods & Duct	--	35	--	35
Sprinkler Piping, Process Piping & Electrical Conduit	31	31	--	62
Subtotal	31	66		97
Totals	**1860**	**1741**	**2758**	**6359**

OPINION OF PROBABLE COST

The Opinion of Probable Cost for demolition was developed using two approaches. The first approach is on the basis of volume of the building, and the second approach on the basis of major building components.

The first approach calculated volume for each building and a unit cost was obtained from R.S. Means Cost Data and applied to the volume. The unit cost includes a 20 mile haul but not the landfill dump fees. The costs are summarized below.

Table 2
Demolition Cost
(Basis of Volume)

Area	Volume (ft^3)	Unit ($/ft^3)	Cost
North Die Cast Bldg	374,111	0.25	$ 93,528
South Die Cast Bldg	374,111	0.25	$ 93,528
Warehouse/Office/Shop	425,500	0.25	$ 106,375
Subtotal	1,114,00		$ 293,431
Contingency 25%			$ 73,358
Total			**$ 366,789**

For the second approach, quantities were calculated for the major components for each building and a unit cost obtained from R.S. Means cost data applied to the quantities. The tabulation of the quantities and costs are provided in Appendix D.

The Opinion of Probable Cost for demolition of the superstructure, i.e that portion of the building above the foundation nearly equals $272,600. The removal of the floor slab and foundation would increase demolition of the building by approximately $175,600. The Opinion of Probable Cost for complete removal of the structure is $448,200.

The probable cost for the total demolition of the three buildings is estimated to range from $367,000 to $448,000. These costs do not include disposal or dump fees at a solid waste landfill.

DEMOLITION SEQUENCE

The demolition contractor will select the most appropriate sequence for the demolition of the three buildings. The following sequence of demolition was assumed in determining costs:

1. Interior appurtenances (conduit, piping, ducts, etc.) removed.
2. Roof appurtenances (cupolas, stacks, etc.) lifted from roof by crane and dismantled.
3. Clearstory, roof substrate and framing removed.
4. Roof trusses removed by crane and set to the side for dismantling.
5. Warehouse/Office area razed.
6. Masonry walls of Die Cast Buildings razed.
7. Foundations and floor slab removed.

DEMOLITION SCHEDULE

It is anticipated that the demolition of the superstructure and the foundations, including the floor slab, can be accomplished in 30 to 60 days.

SUMMARY AND CONCLUSIONS

The Land Reutilization Authority (LRA) - Owned Portion of the Carter Carburetor Facility consists of three buildings sharing common dividing walls and interconnected passage ways to the main Carburetor manufacturing building.

The three single story buildings are North and South Die Cast Buildings and Warehouse/Office/Shop Building. These buildings consists of column free floor areas, masonry bearing walls, and roof consisting of felt and gravel over timber decking. The exterior surface of the masonry walls show deterioration of the mortar joints. These joints have softened and are recessed from the brickface. The visible portions of the foundations, and floor slab revealed no signs of major damage other than minor cracks. The roof framing for the clearstory show

signs of sagging and rotting, and some portions have collapsed in the North Die Cast building. The roof structure in all three buildings do not appear to be in a serviceable condition to provide a watertight building. Major repair and replacement would have to be undertaken to have a serviceable roof system.

The estimated quantity of debris for the three buildings is 5,740 tons or nearly 6,500 cubic yards.

The opinion of probable cost to demolish the three buildings is estimated to range from $369,000 to $448,000. It is anticipated that the demolition of the superstructure and the foundation, including the floor slab, can be accomplished in 30 to 60 days.

* * * * *

APPENDIX A
FIELD SURVEY
DATA SHEETS

STRUCTURAL CONDITION SURVEY
LRA-Owned Portion of
Carter Carburetor Facility
St. Louis, Missouri

Building Area: N. Die Cast   **Date:** _5-12-95_   **Sheet:** _1_ of _4_

Roof Substrate:

Roof Framing:

Primary Framing:

Lateral Bracing System:

Floor:

Arrived at Site 9:50 A.M. at City Maintenance Fence 9:45 A.M.

Exterior: Brick

Foundation: Reinforced Concrete

Mortar joints extreme deterioration, with moss growing in joints

Through bolts typical at wall openings (windows)

East Side: Locations where brick parapet has separated from backing walls (NE Corner) and center pier

STRUCTURAL CONDITION SURVEY
LRA-Owned Portion of
Carter Carburetor Facility
St. Louis, Missouri

Building Area: N. Die Cast   **Date:** _5-12-95_   **Sheet:** _2_ of _4_

Roof Substrate:	
Composite/Asphalt Roll Sheeting	

Roof Framing:
Structural angle bow trusses at 20 ft. c/c ±
Clearstory at center of building, timber framed
Timber decking rotting at low purlins (timber)

Primary Framing:

Masonry walls (bearing)
Supporting roof trusses

Lateral Bracing System:

Roof diaphragm, x-bracing rod between roof trusses

Floor:

Concrete ± 3 ft. below grade (Risers at ± 7" at stair)

Appurtenances:

Conduits, fire sprinkler piping, and process piping

STRUCTURAL CONDITION SURVEY
LRA-Owned Portion of
Carter Carburetor Facility
St. Louis, Missouri

Building Area: Ctr. Die Cast   **Date:** _5-12-95_   **Sheet:** _3_ of _4_

Roof Substrate: Built-up roof, tar/felt and gravel ballast

Roof Framing:
 	
  Bow trusses, clearstory framing/timber
  Trusses @ 16' centers, timber decking/purlins spanning to trusses

Primary Framing:
 	
  Structural steel columns at North wall on concrete piers
  South wall - masonry loading bearing

Lateral Bracing System: Roof diaphragm, x-bracing rod between roof trusses
Floor: Concrete - same elevation as North Die Cast Building
Appurtenances: Conduit, fire sprinkler piping, process piping, and exhaust hoods and ducts

STRUCTURAL CONDITION SURVEY
LRA-Owned Portion of
Carter Carburetor Facility
St. Louis, Missouri

Building Area: S. Die Cast Bldg.   **Date:** _5-12-95_   **Sheet:** _4_ of _4_

|	
Roof Substrate:	
Built-up roof - tar/felt and gravel ballast	
Roof Framing:	
Timber deck/purlins spanning to beam/post joists at 16" o.c.	
Primary Framing:	
Steel beam/post at 22'-0" o.c. Masonry load bearing wall at perimeter WF/pipe columns	
Lateral Bracing System:	
Roof Diaphragm	
Floor: Concrete slab (9" - 10")	
Appurtenances:	
No conduit, on piping, some fixtures and hanging ceiling titles	

APPENDIX B
FIELD
PHOTOGRAPHS
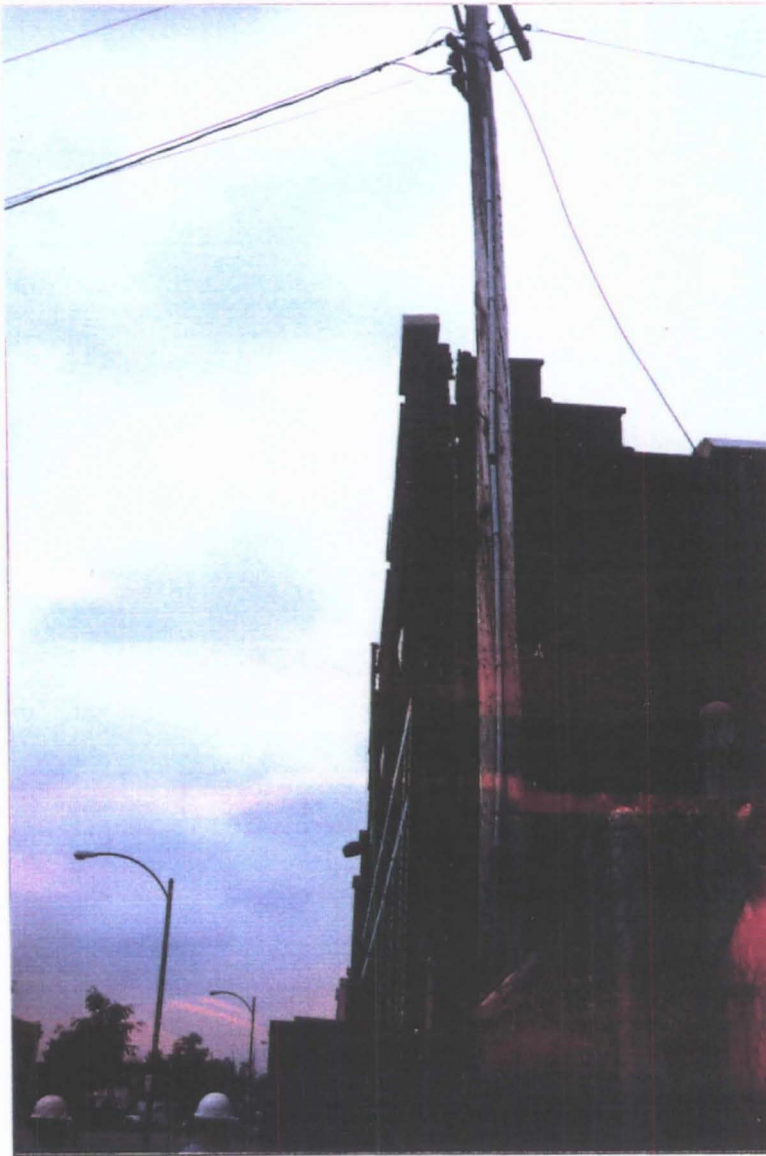
No. 1
North Die Cast Building: View of
Parapet pulled away from
north exterior wall

No. 2
North Die Cast Building: View of
north exterior wall and deterioration
of roof at masonry wall

No. 3
North Die Cast Building: View of
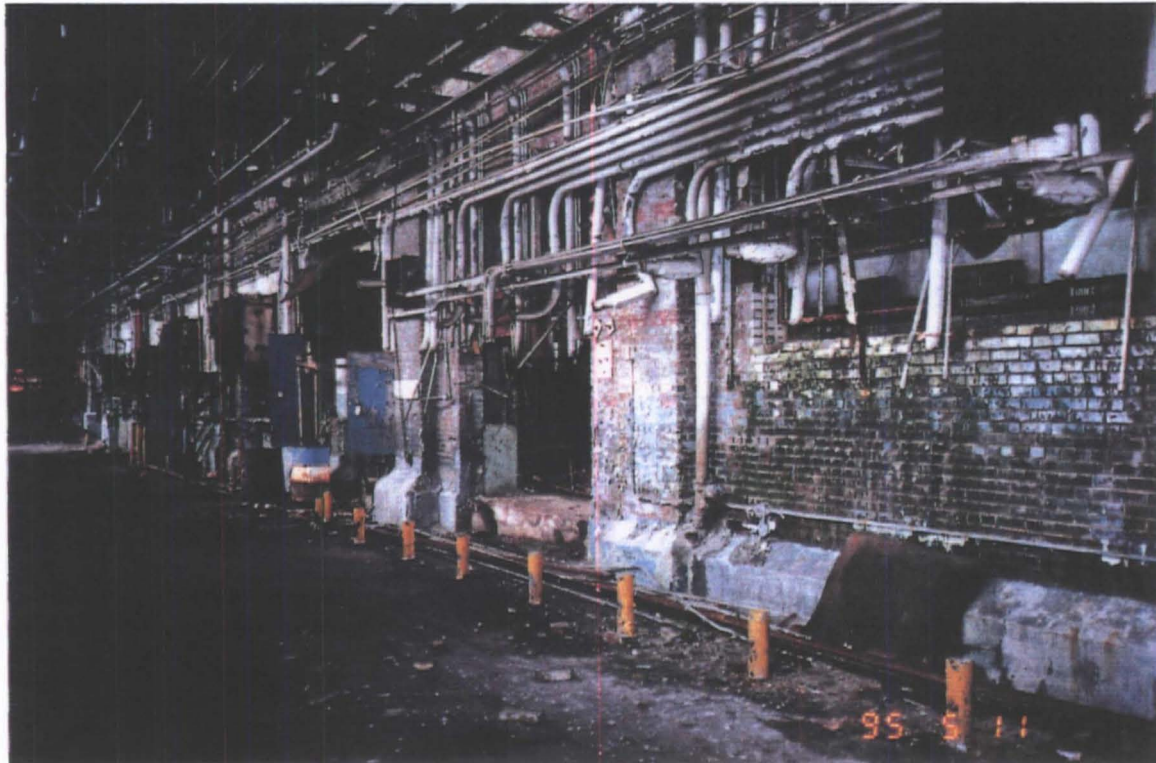brick masonry, missing brick
at case and fascia trim board

No. 4
North Die Cast Building: View of
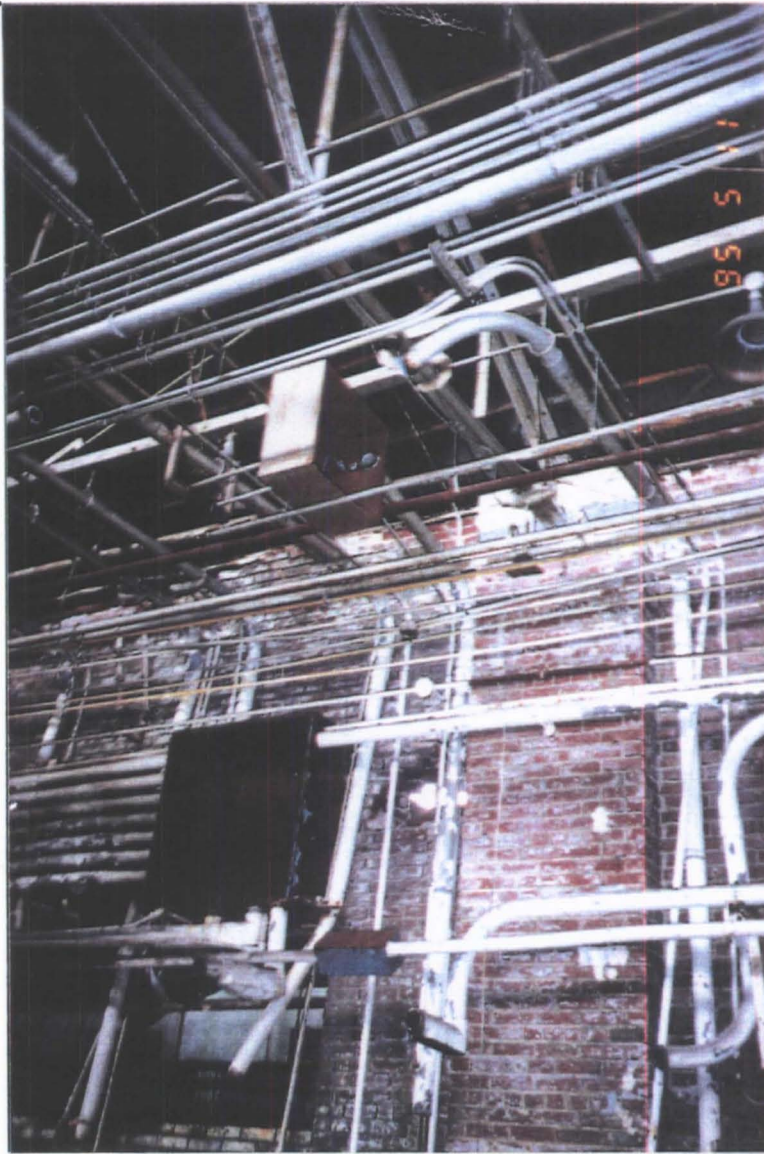mortar joints on exterior
face of masonry wall

No. 5
North Die Cast Building: View looking at north exterior masonry wall
through floor supported pipe rack at center of building

No. 6
North Die Cast Building: View looking towards South Die Cast
Building; common masonry wall, pilasters, and conduit

No. 7
North Die Cast Building: Steel roof truss
bearing on brick masonry pilaster, piping and
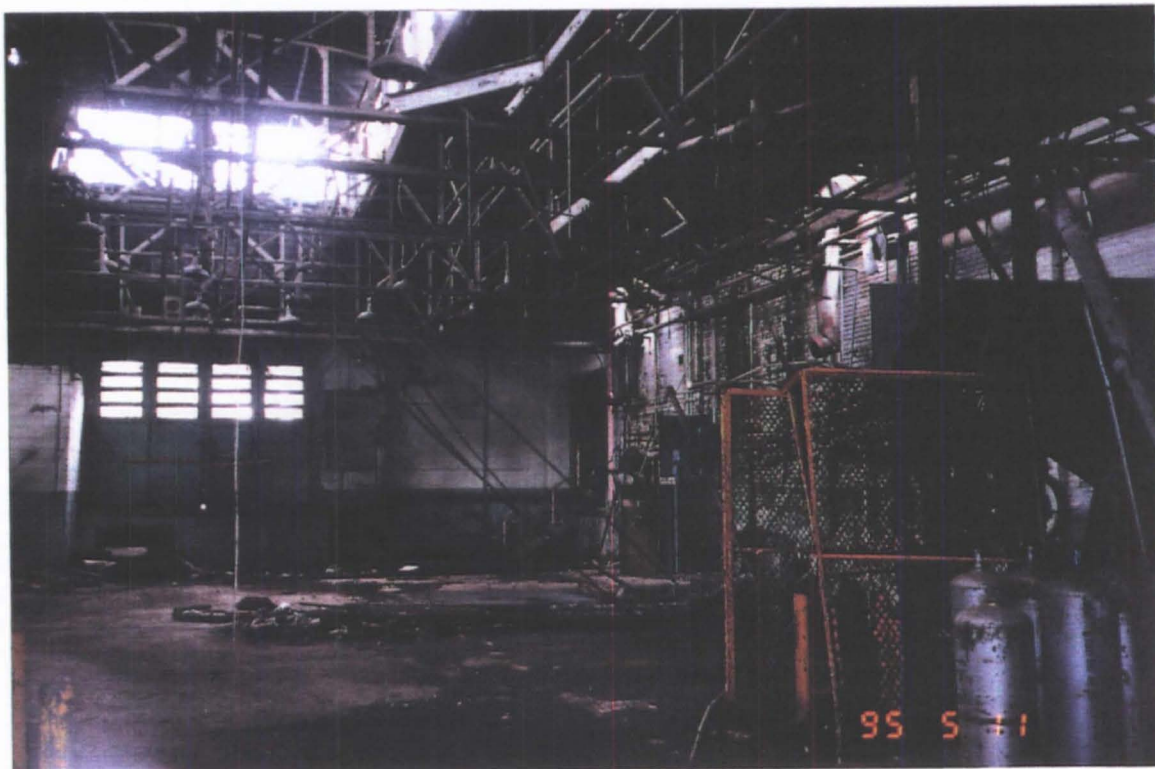conduit supported from roof truss

No. 8
North Die Cast Building: Steel roof truss,
wood joists, and decking; piping and
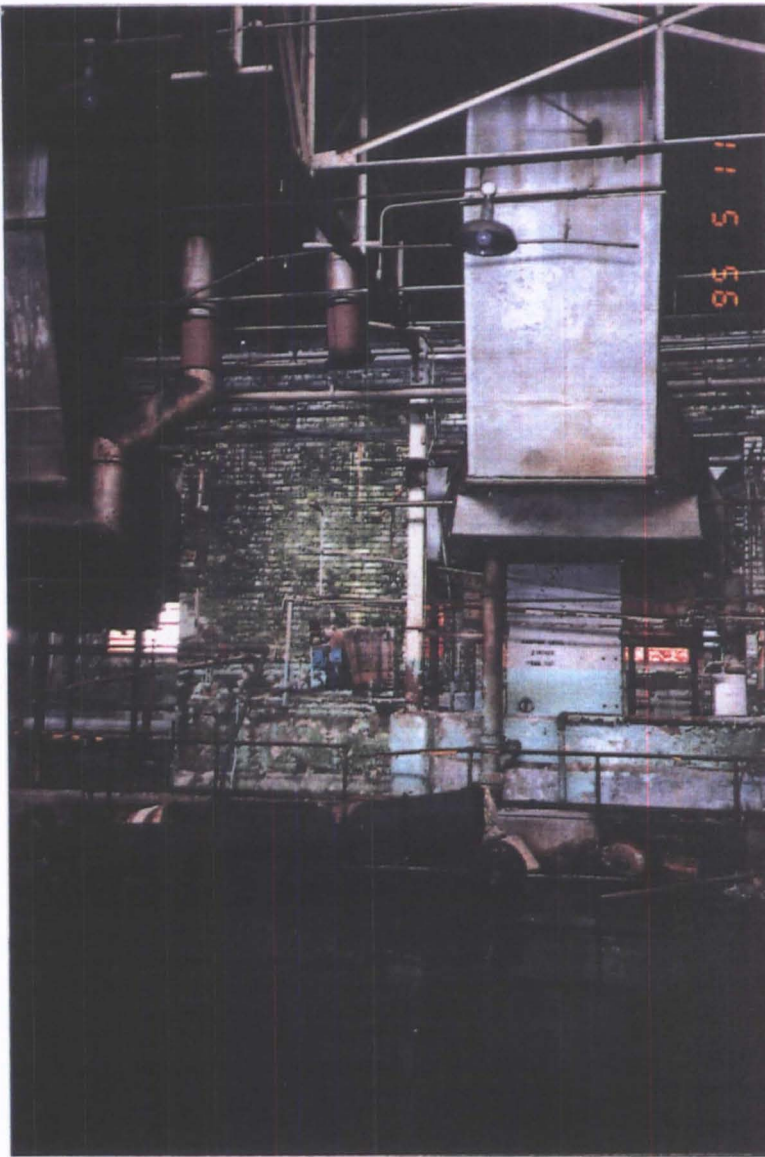other appurtenances supported by roof truss

No. 9
South Die Cast Building: View looking up to clearstory through
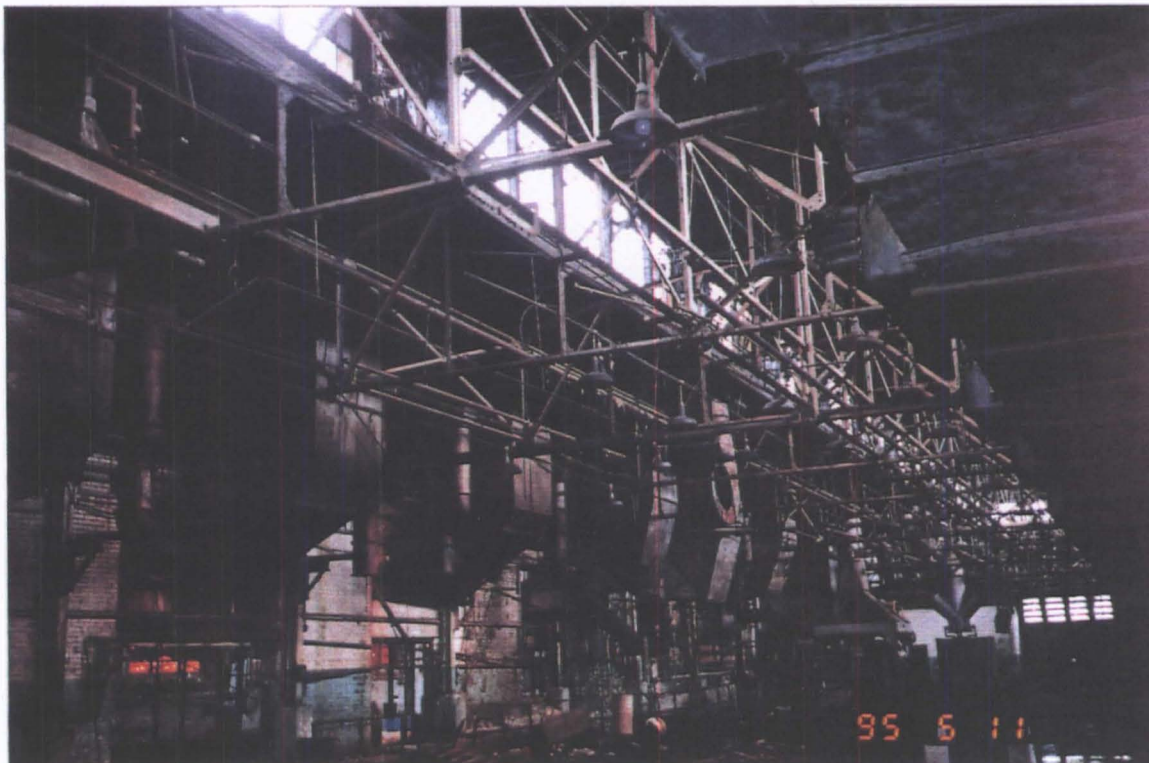steel angle roof trusses

No. 10
South Die Cast Building: View looking towards Grand Avenue
loading dock and doors; piping, light fixtures, and other appurtenances

No. 11
South Die Cast Building: View looking at common wall with North Die Cast Building, concrete pier and steel column supporting steel roof truss

No. 12
South Die Cast Building: View looking towards Grand Avenue, steel roof trusses, steel exhaust hood, piping, conduit, etc.

No. 13
Warehouse/Office & Shop: Brick
Masonry Cavity Wall with South
Die Cast Building

No. 14
Warehouse/Office & Shop: Brick
masonry bearing wall, rolled steel
beam and wood joist framing

No. 15
Warehouse/Office & Shop: Rolled Steel beam and column framing
with timber joists and wood board decking

No. 16
Warehouse/Office & Shop: Interior view of steel column and
fallen ceiling panels on floor

No. 17
North Die Cast Building: Roof and clearstory with vent
hoods penetrating roof

No. 18
South Die Cast Building: Clearstory roof and cupolas and stacks
penetrating roof

No. 19
Warehouse/Office & Shop (foreground): Collapsed roof, South Die Cast Building (Background); cupolas and stacks penetrating roof

No. 20
Warehouse/Office & Shop: Skylights with glazing missing and collapsed roof

No. 21
Warehouse/Office & Shop: Existing
skylights with wireglass glazing broken out

No. 22
Warehouse/Office & Shop: Collapsed
areas of roof

95 5 11

APPENDIX C
DEMOLITION DEBRIS
QUANTITY ESTIMATE

DEMOLITION DEBRIS
LRA-Owned Portion of Carter Carburetor Facility
St. Louis, Missouri

Item	Area/Volume	Units	Unit Weight	Units	Total Weight Pounds	Total Weight Tons	Bulk Density	Units	Total Volume Cubic Feet	Total Volume Cubic Yards
Warehouse/Office/Shop										
Roofing Substrate	26,595	sq.ft	14	lbs/sq.ft	372,330	186	54	lbs/cft	11,722[1]	434
Brick Masonry Wall	14,632	sq.ft	115	lbs/sq.ft	1,682,680	841	115	lbs/cft	19,022[2]	705
Steel Columns	25	each	320	lbs	8,000	4	490	lbs/cft	16	1
Beams	17	each	3,100	lbs	52,700	26	490	lbs/cft	108	4
Beams	8	each	2,360	lbs	18,880	9	490	lbs/cft	39	1
Conc. Foundation	4,749	cft	150	lbs/cft	712,350	356	150	lbs/cft	9,498[3]	352
Floor Slab	17,818	cft	150	lbs/cft	2,672,700	1,336	150	lbs/cft	35,636[3]	1,320
Sub total					5,519,640	2,758			76,041	2,817
South Die Cast Building										
Roofing Substrate	11,660	sq.ft	14	lbs/sq.ft	163,240	82	54	lbs/cft	5,139[1]	190
Roof Trusses	15,900	sq.ft	4	lbs/sq.ft	55,650	28	490	lbs/cft	114	4
Clearstory	7,950	sq.ft	22	lbs/sq.ft	174,900	87	79	lbs/cft	2,214	82
Brick Masonry Wall	5,470	sq.ft	115	lbs/sq.ft	629,050	315	115	lbs/cft	7,111[2]	263
Steel Columns	16	each	434	lbs	6,944	3	490	lbs/cft	14	1
Conc. Foundation	4,810	cft	150	lbs/cft	721,500	361	150	lbs/cft	9,620[3]	356
Floor Slab	10,653	cft	150	lbs/cft	1,597,950	799	150	lbs/cft	21,306[3]	789
Cupolas	12	each	4,115	lbs	49,380	25	-	-	2,208	82
Stacks	10	each	1,250	lbs	12,500	6	-	-	785	29
Duct	1	each	7,680	lbs	7,680	4	-	-	2,304	85
Piping and Conduit	15,360	sq.ft	4	lbs/sq.ft	61,440	31	-	-	-	-
Sub total					3,480,234	1,741			50,815	1,881

Bulking Factors   (1) 1.70   (2) 1.30   (3) 2.0

DEMOLITION DEBRIS
LRA-Owned Portion of Carter Carburetor Facility
St. Louis, Missouri

Item	Area/Volume	Units	Unit Weight	Units	Total Weight Pounds	Total Weight Tons	Bulk Density	Units	Total Volume Cubic Feet	Total Volume Cubic Yards
North Die Cast Building										
Roofing Substrate	11,220	sq.ft	14	lbs/sq.ft	157,080	79	54	lbs/cft	4,945[1]	183
Roof Trusses	15,300	sq.ft	4	lbs/sq.ft	53,550	27	490	lbs/cft	109	4
Clearstory	7,650	sq.ft	22	lbs/sq.ft	168,300	84	79	lbs/cft	2,130	79
Brick Masonry Wall	9,000	sq.ft	115	lbs/sq.ft	1,035,000	518	115	lbs/cft	11,700[2]	433
Conc. Foundation	4,697	cft	150	lbs/cft	704,550	352	150	lbs/cft	9,394[3]	348
Floor Slab	10,251	cft	150	lbs/cft	1,537,650	769	150	lbs/cft	20,502[3]	759
Piping and Conduit	15,300	sq.ft	4	lbs/sq.ft	61,200	31	-	-	-	-
Sub total					3,717,330	1,859			48,780	1,806
	Total Weight of Debris				12,717,204	6,358	**Total Volume of Debris**		175,636	6,504

Bulking Factors   (1) 1.70   (2) 1.30   (3) 2.0

WAREHOUSE/OFFICE/SHOP

1 Planar area for Section 1 = 136.5 x 109' = 14878.5 sq.ft

Planar area for Section 2 = 139' x 77.5' = 10772.5 sq.ft

Planar area for Section 3 = 16' x 47' = 752 sq.ft.

Planar area for Section 4 = 12' x 16' = 192 sq.ft.

Total Planar Area = 26595 sq.ft

Unit weight in pounds

(Roofing Substrate) = 372,330 lbs

2. Brick Masonry Wall

Lengths of different sections of the wall

Section 1 (a) = 140 ft

Section 1 (b) = 47 ft

Section 1 (c) = 105 ft + 35 ft.

Section 1 (d) = 62.5 ft

Section 1 (e) = 255 ft

Section 1 (f) = 93 ft

Section 1 (g) = 85 ft

Section 1 (h) = 42 ft

Miscellaneous = 50 ft

Total Length of the wall = 914.5 ft

Surface Area of the wall = 914.5 x 16

= 14632 sq.ft.

Unit Weight of the Brick Masonry Wall

$$= 115 \text{ lbs/sq. ft}$$

Total Weight in Pounds (Brick Masonry Wall)

$$= 14632 \times 115$$

$$= 1,682,680 \text{ lbs}$$

No. of Steel Columns $= 17 + 8 = 25$

Unit weight of the column $= 20 \text{ lbs/ft}$

Length of the Column $= 16 \text{ ft}$

Weight of each column $= 320 \text{ lbs}$

No. of Beams $= \left[\dfrac{255}{16} + 1 \right] = 17$

Unit Weight of the beam $= 40 \text{ lbs/ft}$

Length of the beam $= 775 \text{ ft}$

Weight of each beam $= 3100 \text{ lbs}$

No. of Beams $= \left[\dfrac{109}{16} + 1 \right] = 8$

Unit Weight of the beam $= 40 \text{ lbs/ft}$

Length of the beam $= 59 \text{ ft}$

Weight of each beam $= 2360 \text{ lbs}$

6

Length of Concrete Foundation

(stem wall) = 914.5 (Rebar Block wall) - 255 (Diff Depth)

$$= 659.5 \text{ feet}$$

Depth = 2 ft

Width = 14 inches

Volume (stem wall) = $659.5 \times 2 \times \dfrac{14}{12}$

$$= 1559 \text{ ft}^3$$

Length of the footing = 659.5 feet

Depth = 1 ft

Width = 18 inches

Volume (footing) = $659.5 \times 1 \times \dfrac{18}{12}$

$$= 988.5 \text{ ft}^3$$

Length of the northside wall foundation

$$= 255 \text{ feet}$$

Depth = 5 ft

Width = 14 inches

Volume (stem wall) = $255 \times 5 \times \dfrac{14}{12}$

$$= 1488 \text{ ft}^2$$

Length of the footing = 255 ft

Depth = 1.33 ft (1'4")

Thickness of the footing = 18 inches

Volume = 508.7 ft³
(footing) =

At each column,

Length of the footing = 1 ft

Depth = 3 ft

width = 3 ft

Volume of each footing at the base
of the column = 9 ft³

Total Volume of the footing at the base
of 25 column = 25 × 9 = 225 ft³

Total volume of the Concrete foundation

= 1539 + 988.5 + 1488 + 508 + 225

= 4749 ft³

7   Area of the Concrete floor = 26595 sq ft

Volume of floor = 26595 × 0.67 ft²

= 17818.65 ft²

Total weight in pounds = 17818.65 × 150
(floor slab) = 2672797.5 lbs

South Die Cast Building

1.

Planar Area for Area 1 (&2)

$$= 22 \times 265 \times 2$$

$$= 11,660 \text{ sq. ft}$$

Unit Weight of the Roofing Material

$$= 14 \text{ lbs/sq. ft}$$

Total Weight in pounds
(Roofing Material) $= 11,660 \times 14$

$$= 163240 \text{ pounds}$$

2.

Truss Span = L = 60 ft

Truss Spacing = S = 20 ft

Load horizontal or UH (lbs/sq.ft) = 1 $\Rightarrow$

$$P = \Sigma (\text{Roof + clearstory})$$

$$= 14 + 22$$

$$= 36 \text{ lbs/sq. ft}$$

Truss wt in lbs/sq.ft of horizontal surface = $\dfrac{3 PL}{450 + 15L + PS}$

$$= \frac{3 \times 36 \times 60}{450 + 15 \times 60 + 36 \times 30}$$

$$= 3.18 \text{ lbs/sq.ft}$$

$\simeq 3.5$ lbs/sq.ft (For misc mat.)

Area of Roof Truss = 60×265 sq.ft

$$= 15900 \text{ sq.ft}$$

Total weight in Pounds (Roof Truss) = $15900 \times 3.5 =$

$$= 55650 \text{ lbs}$$

Width of clear story = $5 + 20 + 5$ ft

$$= 30 \text{ ft}$$

Planar Area of the clear story = 30×265 sq.ft

$$= 7950 \text{ sq.ft}$$

Unit weight of clearstory material

$$= 14 + 8 \text{ lbs/sq.ft}$$

$$= 22 \text{ lbs/sq.ft}$$

Total weight in Pounds (clear story) = $7950 \times 22 = 174900$ lbs

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4

Length of the Brick Masonry Wall

$$= 255 + 60 + 50 \text{ ft}$$

$$= 365 \text{ feet}$$

Area of the Brick Masonry Wall

$$= 365 \times 15 \text{ sq ft}$$

$$= 5475 \text{ sq ft}$$

Unit weight of Brick Masonry Wall

$$= 115 \text{ lbs/sq ft}$$

Total weight in pounds

$$(\text{Brick Masonry Wall}) = 5475 \times 115$$

$$= 629625 \text{ lbs}$$

5.

No of Steel Columns $= \left[\dfrac{237}{16} + 1 \right]$

$$= 15 + 1 = 16$$

Linear unit wt of Steel Column

$$= 31 \text{ lbs/ft}$$

Length of the column = 14 ft

Weight of each Column $= 31 \times 14 = 434 \text{ lbs}$

Total weight in pounds $= 434 \times 16 = 6944 \text{ lbs}$
(Steel Column)

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6

Length of the stem wall

$$= 255 + 60 + 50 + 225$$

$$= 590 \text{ ft}$$

Depth = 5 ft

Thickness = 14 inches

Volume (stem wall) $= 590 \times 5 \times \dfrac{14}{12} = 3442 \text{ ft}^3$

Length of the footing

$$= 590 \text{ ft}$$

Depth = 1.33 ft (1' 4")

Thickness = 18 inches.

Volume (footing) $= 590 \times 1.33 \times \dfrac{18}{12}$

$$= 1177 \text{ ft}^3$$

Volume (footing at the base of the column) $= 1.97 \times 16 = 191.52 \text{ ft}$

Total Volume of Concrete Foundation $= 4810 \text{ ft}^3$

Unit Weight of Concrete Foundation $= 150 \text{ lb}/\text{ft}^3$

Total weight in pounds (Concrete foundation) $= 4810 \times 150$

$$= 721500 \text{ lbs}$$

7.

Area of the floor = 15900 sq ft

Volume = 15900 × 0.67 ft³ = 10653 ft²

Unit wt of the concrete floor = 150 lbs/cu ft

Total wt in lbs = 1597950 lbs

NORTH DIE CAST BUILDING

1. Planar Area of sections 1 & 2

= 22 × 255 × 2

= 11220 sq ft

Unit Weight of the Roofing Material

= 14 lbs/sq ft

Total weight in Pounds
(Roofing Material) = 157080 lbs

2. W = Truss wt in lbs/sq ft of horizontal

surface = 3.5 lbs/sq ft

Area of Roof Truss = 60 × 255 sq ft

= 15300 sq ft

Total weight in Pounds
(Roof Truss) = 15300 × 3.5

= 53550 lbs

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3

Width of Clearstory = 30 ft.

Planar Area of the clear Story = 30 x 255 sq. ft

= 7650 sq. ft.

Unit Weight of clear story Material

= 22 lbs/sq ft.

Total Weight in Pounds

(clearstory) = 7650 x 22

= 168300 lbs

4

Length of the Brick Masonry Wall

= 225 + 60 + 255 + 60

= 600 ft

Area of the Brick Masonry Wall

= 600 x 15 sq. ft

= 9000 sq. ft

Unit Weight of Brick Masonry Wall

= 115 lbs/sq. ft

Total Weight in pounds

(Brick Masonry Wall) = 9000 x 115

= 1035 000 lbs

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5

Length of the stem wall

$$= 600 \text{ ft}$$

Depth $= 5$ ft

Thickness $= 14$ inches

Volume $= 600 \times 5 \times \dfrac{14}{12} = 3500 \text{ ft}^3$
(stem wall)

Length of the footing

$$= 600 \text{ ft}.$$

Depth $= 1.33$ ft.

Thickness $= 18$ inches

Volume $= 600 \times 1.33 \times \dfrac{18}{12} = 1197 \text{ ft}^3$
(footing)

Total Volume of Concrete Foundation $= 4697 \text{ ft}^3$

Unit Weight of Concrete Foundation $= 150 \text{ lbs/ft}^3$

Total weight in Pounds
(Concrete Foundation) $= 704550$ lbs

6.

Area of the floor $= 15,300$ sq. ft.

Volume $= 15300 \times 0.67 \text{ ft}^3$

$$= 10251 \text{ ft}^3$$

Unit Weight of the Concrete floor $= 150 \text{ lbs/ft}^3$

Total wt in Pounds $= 1537650$ lbs

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1. To Calculate the weight of each Cupola

Section (1) = $\frac{1}{2} \times 3 \times 143 = 214.5$ lbs

Section (2) = 1040 lbs

Section (3) = 15 × 143 = 2145 lbs

Section (4) = 5 × 143 = 715 lbs

Total weight of each Cupola = 4115 lbs

No. of Cupolas = 12

Total weight of 12 Cupolas = 49380 lbs

2. To Calculate the weight of the duct including hangers & louvers

Length of the duct = 192 ft

Unit weight = 40 lbs/ft

Total weight of the duct = 7680 lbs

3. To Calculate the weight of each stack

Height of each stack = 25 ft

Unit weight = 50 lbs/ft

Weight of each stack = 50 × 25 = 1250 lb

No. of Stacks = 10

Total weight of 10 stacks = 12,500 lbs

APPENDIX D
DEMOLITION OPINION
OF PROBABLE COST

DEMOLITION DEBRIS
LRA-Owned Portion of Carter Carburetor Facility
St. Louis, Missouri
OPINION OF PROBABLE COST
SUMMARY

Building	Superstructure	Foundation	Total
Warehouse/Office/Shop	$163,659	$78,827	$242,486
South Die Cast Building	56,260	48,630	104,890
North Die Cast Building	52,685	48,150	100,835
Total	$272,604	$175,607	$448,211

DEMOLITION DEBRIS
LRA-Owned Portion of Carter Carburetor Facility
St. Louis, Missouri
OPINION OF PROBABLE COST

Item	Area/Volume	Units	Unit Cost	Units	Total Cost
Warehouse/Office/Shop					
Roofing Substrate	26,595	sq.ft	1.5	sq.ft	$39,893
Brick Masonry Wall	14,632	cft	6.75	cft	98,766
Steel Columns	25	each	500	each	12,500
Beams	17	each	500	each	8,500
Beams	8	each	500	each	4,000
				Sub total	$163,659
Conc. Foundation	1,854	Lin.ft	21	Lin.ft	38,934
Floor Slab	26,595	sq.ft	1.5	sq.ft	39,893
				Sub total	$78,827
South Die Cast Building					
Roofing Substrate	11,660	sq.ft	1.5	sq.ft	$17,490
Roof Trusses	17	each	1000	each	17,000
Clearstory	7,950	sq.ft	0.7	sq.ft	5,565
Brick Masonry Wall	5,470	sq.ft	1.5	sq.ft	8,205
Steel Columns	16	each	500	each	8,000
				Sub total	$56,260
Conc. Foundation	1,180	Lin.ft	21	Lin.ft	24,780
Floor Slab	15,900	sq.ft	1.5	sq.ft	23,850
				Sub total	$48,630
North Die Cast Building					
Roofing Substrate	11,220	sq.ft	1.5	sq.ft	$16,830
Roof Trussess	17	each	1000	each	17,000
Clearstory	7,650	sq.ft	0.7	sq.ft	5,355
Brick Masonry Wall	9,000	sq.ft	1.5	sq.ft	13,500
				Sub total	$52,685
Conc. Foundation	1,200	Lin.ft	21	Lin.ft	25,200
Floor Slab	15,300	sq.ft	1.5	sq.ft	22,950
				Sub total	$48,150
			Total Cost of Demolition		$448,211

DEMOLITION DEBRIS
LRA-Owned Portion of Carter Carburetor Facility
St. Louis, Missouri
OPINION OF PROBABLE COST
SUMMARY

Building	Interior Volume	Units	Cost
Warehouse/Office/Shop	425,500	cft	$106,375
South Die Cast Building	374,111	cft	93,528
North Die Cast Building	374,111	cft	93,528
Total	**1,173,722**	**cft**	**$293,431**

Note: All costs based on interior volume

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1

TO CALCULATE THE INTERIOR VOLUMES
WAREHOUSE/OFFICE/SHOP

Section (1) = 59 x 93.5 x 16 = 88,264 Cft
Section (2) = 80 x 77.5 x 16 = 99,200 Cft
Section (3) = 109 x 136.5 x 16 = 238,056 Cft

Total = 425,520 cft

2.

SOUTH DIE CAST BUILDING / NORTH DIE CAST BUILDING

Section (1) (Base) = 255 x 60 x 17.5 = 267,750 Cft
Section (2) (curvidaua) = 313.18 x 255
(determined from AutoCad →

= 79,861 Cft

Section (3) (clear story) = 20 x 5 x 256

= 26,500 Cft

Total = 374,111 Cft

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Volume of each Cupola (based on size)

Section (1) $= \frac{1}{2} \times \frac{\pi}{4} \times 3^2 \times 3 = 10.66$ cft

Section (2) $= \frac{\pi \times 3^2}{4} \times \frac{1}{2} + \frac{1}{2} \times \frac{\pi \times 3^2}{4} \times 2$

$= 21$ cft

Section (3) $= \frac{\pi \times 3^2}{4} \times 15 = 106.02$ cft

Section (4) $= \frac{\pi \times 3^2}{4} \times 6.5 = 45.95$ cft

Steel Volume of each cupola $= 184$

Total Volume of 12 Cupolas $= 2208$ cft

Volume of the duct $= 3 \times 4 \times 192$

$= 2304$ cft

Volume of each Stack

$= \frac{\pi}{4} \times 2^2 \times 20 \times 5$

$= 78.54$ cft

Total Volume of 10 stacks

$= 785.40$ cft